In [1]:
```
using Plots
```

In [7]:
```
plotly()
```

Out[7]:
```
Plots.PlotlyBackend()
```

hint for 問 3 (1)

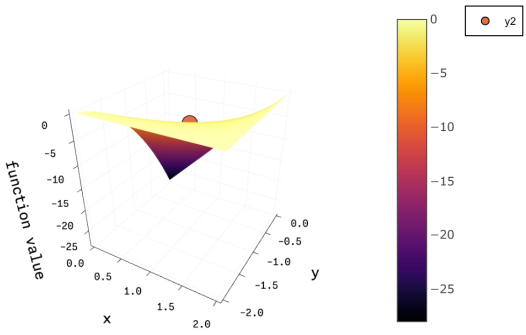
In [2]:
```
X = 0:0.01:2
Y = -2:0.01:0

Z = [ 3*x^2*y + x*y for x in X, y in Y ]
```

Out[2]:
```
201×201 Matrix{Float64}:
  -0.0      -0.0        -0.0        -0.0        …  -0.0       -0.0       0.0
  -0.0206   -0.020497   -0.020394   -0.020291      -0.000206  -0.000103  0.0
  -0.0424   -0.042188   -0.041976   -0.041764      -0.000424  -0.000212  0.0
  -0.0654   -0.065073   -0.064746   -0.064419      -0.000654  -0.000327  0.0
  -0.0896   -0.089152   -0.088704   -0.088256      -0.000896  -0.000448  0.0
  -0.115    -0.114425   -0.11385    -0.113275   …  -0.00115   -0.000575  0.0
  -0.1416   -0.140892   -0.140184   -0.139476      -0.001416  -0.000708  0.0
  -0.1694   -0.168553   -0.167706   -0.166859      -0.001694  -0.000847  0.0
  -0.1984   -0.197408   -0.196416   -0.195424      -0.001984  -0.000992  0.0
  -0.2286   -0.227457   -0.226314   -0.225171      -0.002286  -0.001143  0.0
  -0.26     -0.2587     -0.2574     -0.2561     …  -0.0026    -0.0013    0.0
  -0.2926   -0.291137   -0.289674   -0.288211      -0.002926  -0.001463  0.0
  -0.3264   -0.324768   -0.323136   -0.321504      -0.003264  -0.001632  0.0
   ⋮                                 ⋱                                  ⋮
 -25.2126  -25.0865    -24.9605    -24.8344        -0.252126  -0.126063  0.0
 -25.46    -25.3327    -25.2054    -25.0781     …  -0.2546    -0.1273    0.0
 -25.7086  -25.5801    -25.4515    -25.323         -0.257086  -0.128543  0.0
 -25.9584  -25.8286    -25.6988    -25.569         -0.259584  -0.129792  0.0
 -26.2094  -26.0784    -25.9473    -25.8163        -0.262094  -0.131047  0.0
 -26.4616  -26.3293    -26.197     -26.0647        -0.264616  -0.132308  0.0
 -26.715   -26.5814    -26.4478    -26.3143     …  -0.26715   -0.133575  0.0
 -26.9696  -26.8348    -26.6999    -26.5651        -0.269696  -0.134848  0.0
 -27.2254  -27.0893    -26.9531    -26.817         -0.272254  -0.136127  0.0
 -27.4824  -27.345     -27.2076    -27.0702        -0.274824  -0.137412  0.0
 -27.7406  -27.6019    -27.4632    -27.3245        -0.277406  -0.138703  0.0
 -28.0     -27.86      -27.72      -27.58       …  -0.28      -0.14      0.0
```

In [13]:
```
surface( X, Y, Z, xlabel = "x", ylabel = "y", zlabel = "function value" )
scatter!( [1.0], [-1.0], [-4])
```

Out[13]:



hint for 問 4 (3)

In [1]:
```
using SymPy
@syms t w
```

Out[1]:
```
(t,)
```

In [3]:
```
eq1 = cos(t)
eq2 = t^2
eq3 = exp( eq1^2 * eq2 )
```

Out[3]:
$$e^{t^2 \cos^2(t)}$$

In [5]:
```
diff( eq3, t )
```

Out[5]:
$$\left(-2t^2 \sin(t)\cos(t) + 2t\cos^2(t)\right) e^{t^2\cos^2(t)}$$

hint for 問 5 (3)

In [8]:
```
f = SymFunction("f")
```

Out[8]:
$$f$$

In [12]:
```
eq1 = 2t - 3w
eq2 = t - 5w

diff( f(eq1, eq2), t )
```

Out[12]:
$$2\left.\frac{\partial}{\partial \xi_1} f(\xi_1, t-5w)\right|_{\xi_1=2t-3w} + \left.\frac{\partial}{\partial \xi_2} f(2t-3w, \xi_2)\right|_{\xi_2=t-5w}$$

In [13]:
```
diff( f(eq1, eq2), w )
```

Out[13]:
$$-3\left.\frac{\partial}{\partial \xi_1} f(\xi_1, t-5w)\right|_{\xi_1=2t-3w} - 5\left.\frac{\partial}{\partial \xi_2} f(2t-3w, \xi_2)\right|_{\xi_2=t-5w}$$

hint for 問 8 (1)

In [14]:
```
@syms r
```

Out[14]:
```
(r,)
```

In [15]:
```
eq1 = r * cos(t)
eq2 = r * sin(t)

diff( f(eq1, eq2), r )
```

Out[15]:
$$\sin(t)\left.\frac{\partial}{\partial \xi_2} f(r\cos(t), \xi_2)\right|_{\xi_2=r\sin(t)} + \cos(t)\left.\frac{\partial}{\partial \xi_1} f(\xi_1, r\sin(t))\right|_{\xi_1=r\cos(t)}$$

In [16]:
```
diff( f(eq1, eq2), t )
```

Out[16]:
$$-r\sin(t)\left.\frac{\partial}{\partial \xi_1} f(\xi_1, r\sin(t))\right|_{\xi_1=r\cos(t)} + r\cos(t)\left.\frac{\partial}{\partial \xi_2} f(r\cos(t), \xi_2)\right|_{\xi_2=r\sin(t)}$$

In [ ]: